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FABRICATION OF HOLLOW SHELL ICF TARGETS USING A DEPOLYMERIZABLE MANDREL

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We continued development of a technology to produce hollow shell laser fusion fuel capsules starting with a depolymerizable mandrel. In this technique we use poly(alpha-methystyrene) (PAMS) beads or shells as mandrels which are overcoated with plasma polymer. The PAMS mandrel is then thermally depolymerized to gas phase monomer which diffuses away through the permeable and more thermally stable plasma polymer coating, leaving a hollow shell. We have developed methods for controlling the size of the PAMS mandrel by either grinding to make smaller sizes or melt sintering to form larger mandrels. Sphericity and surface finish are improved by heating the PAMS mandrels in hot water using a surfactant to prevent aggregation. Problems with shell bursting due to too rapid an evolution of monomer were controlled through the heating rate and related studies of the depolymerization kinetics. Using this technique we have made mandrels from 200 μm to 4 mm diameter with sphericity better than 2 μm and local surface finish better than 10 nm RMS. We characterized sphericity through each step of the process and found that distortion occurs mainly during pyrolysis. To eliminate this distortion, we are investigating methods for achieving a uniform thermal and stress environment during pyrolysis.

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